



Cochlear implantation surgery experience of a tertiary clinic

Cochlear Implantation

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This study is presented at 8th Instructional workshop European Academy of Otolology and Neuro-Otology, 18-21 January 2017, Izmir, Turkey.

Abstract

Aim: Cochlear implantation (CI) is a commonly performed procedure for severe to profound deafness in patients. It has been widely used for this purpose, and it becomes more complicated than expected for new institutes. In this report, we aimed to discuss the patient features, surgery indications, results of the CI surgeries in the experience of a single center. **Material and Method:** We retrospectively analyzed 65 patients who were underwent CI in a tertiary hospital. Hearing loss etiologies, hearing results and postoperative complications were assessed. **Results:** Sixty-five patients were evaluated within in two groups as 0-6 years-old and over 7 years-old. Twenty-nine patients were placed in 0-6 years-old group, and 36 patients were placed in over 7-years-old group. In 0-6-years-old group; 27 patients hearing loss remained idiopathic, but 1 patient had Cogan syndrome, and 1 patient had a cochlear malformation. Hearing gain of the entire group was found statistically significant ($p<0.000$). In over 7-years-old group; 1 patient underwent CI for each of indications: traumatic hearing loss, iatrogenic cochlear damage, Meniere's disease, chronic otitis media, electrode renewing. The etiology of the 31 patients were not revealed in the over 7-years-old group. The hearing gain of the group was found statistically significant ($p<0.000$). One patient had a dural injury, and 1 patient had a round window gusher. Six patients had postoperative vertigo. Post-implantation facial nerve stimulation was revealed in 1 patient. **Discussion:** CI is a very revolutionary technic for the hearing-impaired patients. The implant success is strongly related to the patient management and appropriate surgical technics

Keywords

Cochlear Implantation; Hearing Loss; Complication; Indication

DOI: 10.4328/JCAM.5639 Received: 24.12.2017 Accepted: 05.01.2018 Published Online: 10.01.2018 Printed: 01.05.2018 J Clin Anal Med 2018;9(3): 209-12
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Introduction

Cochlear implantation (CI) has developed into a commonly performed procedure for severe to profound deafness in patients. The development of the audiological test batteries eased to obtain the hearing impairments, and the newborn hearing screening made early detection of hearing loss [1]. The early detection of the deafness in children affects the development of speech perception, language, and reading skills [2]. The appropriate management of the hearing loss decreases the morbidity and contribute to the country's economic aspects. CI has a great value for the profound hearing loss, however surgical procedures are still challenging for the physicians and patients. The complex anatomy, naive structures, and inappropriate surgical interventions may cause the complications. But developing operative technics and new instruments pioneer the improvement of the CI success.

In this report; we aimed to discuss the indications, hearing results of the CI surgeries with the data of CIs recipients and management of the complications due to a tertiary clinic experience.

Material and Method

This study is designed as an observational, descriptive study and the data was collected retrospectively from the patient records. Sixty-five patients, who received CI surgery in XXX Otorhinolaryngology department between 2012 and 2015, were the main subjects.

The following data has been studied: hearing and medical history, the age of implantation, deafness etiology, radiological images (computerized tomography and magnetic resonance images), intraoperative findings, and postoperative complications.

Population: Patients were divided into the two subgroups according to their lingual, prelingual and postlingual development. Twenty-nine (44%) children were evaluated in the prelingual group and age distribution of CI was 0-60 months (mean: 26,2; median: 8; min: 14; max: 52 months). Sixteen (55%) patients were girls, and 13 (45%) were boys. Thirty-six (56%) patients were classified in the postlingual group, and CI age of individuals differed from 10 to 65 years. Mean age was 34,1 years (median: 21; min: 10, max: 65 years). Gender distribution was as 21 (58%) males, 15 (42%) females. Three different CI systems (Clarion®, Medel®, Nucleus®) were used in different numbers.

Hearing Tests: The prelingual group was assessed with visual reinforcement or conditioned play audiometry (Interacoustics® AS DK-5610 Assens, Denmark) in the preoperative period. Postoperative hearing with the CI was monitored with a warble tone free field audiometry test. Hearing levels and gains were recorded at 250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz frequencies.

The postlingual group was tested on mentioned frequencies with pure tone audiometer without hearing aid. Free field levels with hearing aids were recorded before the CI and during the postoperative period.

All statistical analyses were performed using SPSS v.20.0 (SPSS, IBM®, Chicago, IL, USA). Kolmogorov-Smirnov tests were used to detect the normality of data distribution. Related variables were expressed as mean, standard deviation (normal distribu-

tion) and median, 25th-75th percentiles (non-normal distribution). Comparisons of groups were performed using the Wilcoxon and Friedman and Dunn's test (Non-normal distribution). Statistically, significance was accepted for p-values < 0.05.

Ethics Statement: The local ethics committee of the XXX approved this clinical study (XXX). The participants or their parents gave their informed consent for evaluating the data for this study.

Results

Total of 65 patients were evaluated within in two groups as 0-6 years-old and over 7-years-old. Twenty-nine patients were placed in 0-6 years-old group, and 36 patients were placed in over 7-years-old group. In 0-6 years-old group; 1 patient with Cogan syndrome and 1 patient with cochlear anomaly underwent CI, and 27 patients who received CI remained idiopathic (Figure 1). Hearing gain of the entire group was found statistically significant (p<0.001) (Figure 2).

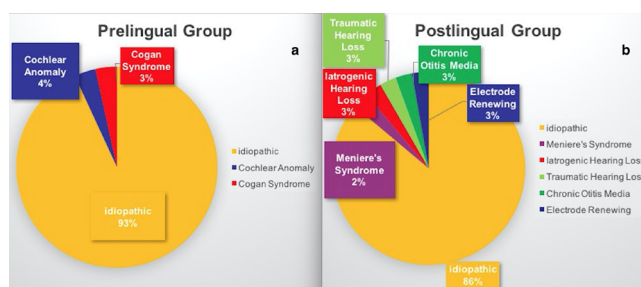


Figure 1. Patient numbers of the etiology according to the groups. a. Prelingual. b. Postlingual group

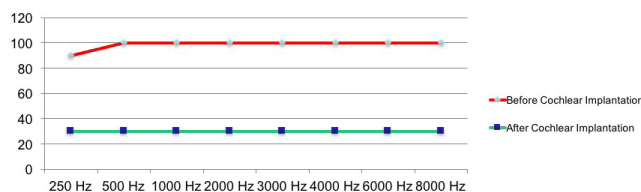


Figure 2. Line graph: Hearing results of the prelingual group

The group which is over 7-years-old contained various reasons for the profound hearing loss. One patient (2.7%) had a traumatic hearing loss, 1 patient (2.7%) had iatrogenic cochlear damage, 1 patient (2.7%) had severe Meniere's disease, 1 patient (2.7%) had hearing loss secondary to long-term chronic otitis media. One (2.7%) patient was undergoing electrode renewing, and etiology of the 31 patients was not revealed clearly (Figure 1). Hearing gain of the whole group was found statistically significant (p<0,000) (Figure 3).

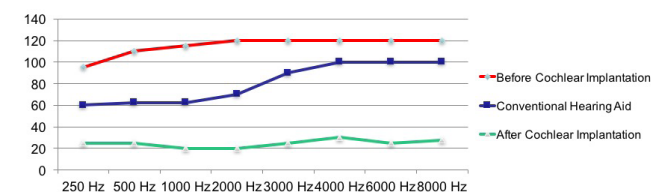


Figure 3. Hearing results of the postlingual group

The analyzed data of the 65 patients showed moderate intraoperative complications in 2 patients (3%). One patient (1.5%) had a dural injury. One patient (1.5%) had a round window

gusher. Six patients (9%) had postoperative vertigo. Post-implantation facial nerve stimulation was seen in 1 patient (1.5%).

Discussion

CI improved the auditory skills of the patients who did not benefit from hearing aid use however the outcome of the surgery depends on a number of variables. Swami et al. reported the duration of auditory deprivation, parental education, and cochlear morphology have a direct impact on the outcomes of CI [3]. In our study, patients received CI surgery in 9.2 months after the first diagnosis. It is related to the conventional hearing aid usage period (6 months) and preoperative evaluation (radiological, psychiatric assessment). After considering these reasons patients received a great hearing gain in our study.

Cogan syndrome was defined as the interstitial keratitis, and bilateral audiovestibular disorders (hearing loss, dizziness, etc.) and the literature mentioned that the patients with Cogan syndrome might benefit from the CI [4]. Due to the literature, implantation was performed, and our patient benefitted from the CI in the long term.

Meniere's disease is inner ear disorder which demonstrates with vertigo episodes, progressive fluctuating hearing loss and patients can be affected bilaterally. Long-term progression can end up with a profound hearing loss [5], and a CI is a treatment option for these patients [6]. We also performed a CI surgery to a patient, who had a profound hearing loss because of the Meniere's disease, and the patient had a great hearing gain after all. Idiopathic sudden sensorineural hearing loss (ISSNHL) is a sensorineural hearing loss of more than 30 dB in 3 adjacent frequencies in less than 3 days, and hearing loss can vary from mild to profound hearing loss [7]. CI is currently an effective treatment option in spite of the proper medical treatment, and Lee et al. suggest CI 3 months after the hearing loss [8]. In our study; 3 patients, who suffer from ISSNHL in their only hearing ear, received the implantation for this purpose and all of the patients regained hearing significantly. CI in chronic otitis media is still a debate in the current literature. Electrode implantation with sterile conditions and recreation of a non-infected middle ear are vital on this purpose. Suppuration in chronic otitis media may lead to electrode array to be lost, and it is better to perform CI after the eradication of the disease [9]. Two-step surgery is suggested in chronic otitis with cholesteatoma, the first step is the eradication of the disease (tympanoplasty, mastoidectomy, etc.) and the second step is CI [10]. We followed two patients, who underwent intact canal mastoidectomy for a year, and implantation was performed after that. No complication neither disease recurrent occurred, and patients were satisfied with their hearing results. Vertigo after the CI surgery may be caused by the loss of the perilymph and diminish in the short term. Persistent vertigo may be related to a perilymphatic fistula [11]. Another study revealed that the benign positional vertigo could be found more frequently in these patients than normal population [12]. In our study, 5 patients recovered spontaneously after few weeks but 1 patient, who had severe Meniere's disease, had mild vertigo after the surgery and no additional treatment was required by the patient. Facial nerve stimulation after the CI is a frequent and well-known complication. The sclerotic cochlea, malformations and ascending stimulation levels are some of

the causes of this clinical entity. Fitting modifications and reducing the electrode stimulations can eradicate mostly [13]. In our study, a patient faced an uncomfortable the post-implantation facial nerve stimulation, and responsible electrodes were canceled with a minimum influence on speech recognition. Cerebrospinal gusher is a frightening complication for the physicians, and anatomical variations or cochlear malformations may result in this clinical situation [14]. The common cavity is a malformation which has a cerebrospinal gusher risk [15]. In our study; cerebrospinal gusher occurred in 1 patient, who had a common cavity malformation, and the leakage was obliterated with soft tissue (temporalis muscle fascia).

Conclusion

CI is a very revolutionary technic for the hearing-impaired patients because of the gain levels. The implant success is strongly related to the patient management and appropriate surgical technics.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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How to cite this article:

Mutlu A, Iseri M, Durgut M, Topdag M, Erdogan S, Ozturk M. Cochlear implantation surgery experience of a tertiary clinic. *J Clin Anal Med* 2018;9(3): 209-12.